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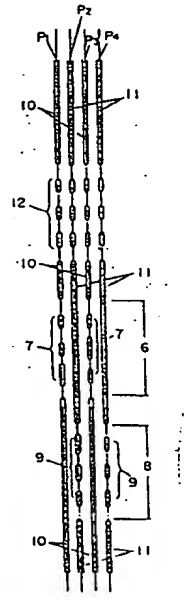
(54) DISK-SHAPED RECORD CARRIER.

(57) A disk-shaped record carrier which has circular or spiral recording tracks in the radial direction maintaining a predetermined pitch, each recording track being provided with a pre-group (2) which consists of protruding strips or a recessed strips, and with discrete signal discrimination portions (7, 9) of a protruding or recessed shape. The signal discrimination portions (7, 9) are so arranged that they will not be adjacent to each other between the neighboring recording tracks. This makes it possible to reduce crosstalk between the signal discrimination portions (7, 9) of the neighboring recording tracks at the time of reproducing data, so as to stably and correctly reproduce the discrimination signals.



EP 0 193 614 A1

TITLE MODIFIED
see front page

SPECIFICATION

Title of the Invention

Disk-Type Recording Medium

Technical Field

The present invention relates to the structure of information storage tracks on a disk-type recording medium (hereinafter simply referred to as "disk") and, more particularly, to the organization of depressions corresponding to address signals or other identifying signals and pregrooves preceding the depressions on a recordable disk.

Background Art

A currently available disk that is used with a disk player for recording and playing back information with a light beam is fabricated as follows. First, pregrooves that act as storage tracks are formed. Then, identifying signals, such as address signals indicative of the addresses of the pregrooves, are recorded in the pregrooves in the form of ridges, depressions, or reflectivity variations. This conventional recordable disk is described further detail by referring to Fig. 1.

Referring to Fig. 1, the aforementioned disk that allows information to be written to, or read from, the

disk is indicated by numeral 1. Tracks P storing information are so formed on the disk that they draw circles or spirals around the center of the disk. The circles or spirals are uniformly spaced from one another. Pregrooves 2 are formed along the tracks P. Address signals indicating the addresses of the pregrooves 2 are recorded in the form of discrete depressions 3 or ridges in the pregrooves, one depression 3 per turn of pregroove 2. Some depressions 3 are also shown in Fig. 1 to an enlarged scale.

The pregrooves 2 are generally radially spaced about 1.6 microns from one another. The pregrooves 2 have a width of about 0.7 micron and a height of about 0.8 micron. Although the pregrooves 2 are shown to be microscopic depressions, microscopic ridges or protrusions may be formed instead.

Fig. 2 shows the pits corresponding to signals and the depressions corresponding to address signals to an enlarged scale, the pits being recorded in the pregrooves 2 of the storage tracks P_1-P_3. The pits, indicated by numeral 4, corresponding to the signals are formed by illuminating the disk with a laser beam while rotating the disk 1. The laser beam is modulated with a signal to be recorded. The layers in the pregrooves which store

information are made to exhibit variations in the reflectivity, for example, by the formation of the pits 4. The depressions 3 corresponding to address signals are discrete similarly to the pregrooves. Also, ridges or protrusions may be formed instead of the depressions 3. The pits 4 and depressions 3 are read by a laser beam 5 focused on the disk. Since the pits 4 are substantially narrower than the depressions 3, when any one track of the pregrooves 2, for example, the pits 4 formed in the pregrooves P_2, is read, it is little likely that the laser beam 5 hits the pits 4 in a neighboring track P_1 or P_3. Hence, the level of crosstalk which is produced between neighboring pregrooves and introduced into the reproduced signals is not so high as to present problems. However, the depressions 3 corresponding to address signals have a larger width. Therefore, it is very likely that the laser beam 5 strikes the depressions of neighboring tracks. Another problem arises from the fact that a considerable amount of crosstalk is produced, because address signals are recorded on the disk as changes in geometrical shape, such as depressions or ridges. In this way, the conventional disk has posed some problems. That is, in the conventional recordable disk, the depressions 3 corresponding to address signals are formed in neighboring positions on

the storage tracks on the disk 1 and, therefore, crosstalk is always produced between the depressions 3 in neighboring tracks. This crosstalk increases the amount of noise contained in the reproduced address signal, i.e., the signal-to-noise ratio deteriorates. As a result, a large quantity of error is produced in reading information. This has created a great problem when the recordable disk is used.

Disclosure of Invention

It is the object of the present invention to provide a disk-type recording medium which permits only a greatly reduced amount of crosstalk to occur between identifying signals such as address signals, for enabling stable reproduction of the identifying signals. In a disk-type recording medium fabricated in accordance with the present invention, tracks storing information are formed at regular intervals around the center of the disk. Each track has pregrooves and discrete depressions corresponding to identifying signals. Instead, ridges and discrete protrusions may be formed. Pits corresponding to signals are formed in the pregrooves. This medium is characterized in that the depressions corresponding to identifying signals are so located in the tracks that the depressions of any one track do not neighbor the depressions

of the neighboring tracks.

When the recording medium constructed as described above is played back, the laser beam used for the playback does not fall on the depressions of two or more neighboring tracks simultaneously. Therefore, no crosstalk is produced between the depressions of neighboring tracks. Consequently, identifying signals such as address signals can be stably reproduced.

Brief Description of Drawings

Fig. 1 is a schematic plan view of a conventional, recordable disk, also showing a portion of the disk to an enlarged scale;

Fig. 2 is a schematic, enlarged plan view of the pregrooves and the depressions corresponding to address signals on the conventional disk shown in Fig. 1;

Fig. 3 is a schematic, enlarged plan view of pregrooves and depressions formed on a disk according to the invention;

Fig. 4 is a schematic, enlarged plan view of the address marks and depressions formed on the disk described just above;

Fig. 5 is a block diagram of a means for detecting address signals;

Fig. 6 is a waveform chart for showing the time

for which address signals are reproduced from a disk according to the invention; and

Fig. 7 is a schematic, enlarged perspective view of main portions of another disk according to the invention.

Best Mode for Carrying Out the Invention

Referring to Fig. 3, there is shown a portion of a disk according to the present invention. This disk has tracks P_1, P_2, P_3, and P_4 storing information. The track P_1 has depressions 7 corresponding to an address signal in a section 6. The next track P_2 has depressions 8 corresponding to an address signal in a section 8. Similarly, the next track P_3 has depressions 6 corresponding to an address signal in the section 6. The track P_4 has depressions 9 corresponding to an address signal in the section 8. The tracks P_1 and P_3 have pregrooves 10. The tracks P_2 and P_4 have pregrooves 11. Thus, the depressions 7 and 9 of neighboring tracks are so located that they do not neighbor on this disk.

In the past, as shown in Fig. 2, when the depressions formed in the track P_2 and corresponding to an address signal were read out, the resulting signal would have been affected by address signals reproduced from

the tracks P_1 and P_3, i.e., crosstalk would have occurred between them. However, in the novel structure shown in Fig. 3, those which neighbor the depressions 9 in the tracks, e.g., track P_2, are only the pregrooves 10 of the neighboring tracks P_1 and P_3. When information is read from the disk, no crosstalk takes place between the address signals reproduced from the depressions 7 and 9.

Referring next to Fig. 4, there is shown a portion of another disk according to the invention. This disk also has tracks P_1-P_4 storing information. The tracks P_1 and P_3 have pregrooves 10. The tracks P_2 and P_4 have pregrooves 11. Each track has address marks 12 which precede depressions 7 or 9 corresponding to address signals to indicate the existence of these depressions beforehand. Since address mark signals are recorded in the tracks P_1-P_4 in a common signal format, the address marks 12 can be read even if crosstalk occurs during playback. Therefore, the tracks P_1-P_4 are so located as to neighbor one another. Also, the address marks 12 neighbor one another, because they are disposed in given positions in the tracks P_1-P_4 to foretell the positions of the depressions 7 and 9.

Fig. 5 is a block diagram of a circuit for

detecting the depressions 7 and 9 corresponding to address signals when the disk having the depressions 7 and 9 shown in Fig. 4 is played back. The recordable disk having grooves and depressions storing information as shown in Fig. 4 is indicated by numeral 13. The disk 13 is rotated by an electric motor 14. An optical head 15 makes use of a laser beam to record information in the progrooves in the tracks of the disk and to read the previously formed depressions 7, 9, the address marks 12, as well as the pits in the recorded pregrooves 10, 11 . corresponding to signals. A preamplifier 16 amplifies the output signal from the head 15 after separating address signals from address mark signals. A converter 17 shapes the waveform of the output from the preamplifier 16 at a certain level and converts it into two-value signal. A shift register 18 has a capacity sufficient to hold an amount of data beginning with the foremost address mark 12 and ending with the rearmost depression 9. The output of the register 18 is connected to an address mark detector 19. When any address mark 12 is detected, the detector 19 controls a gate 20 in such a way that the output signal from a clock generator 21 is cut off. Thus, addresses 7 and 9 are held in those portions of the shift register 18 which are close to its input terminal, the

held addresses appearing at an output terminal 22.

Fig. 6 is a timing chart of waveforms obtained by reading the depressions 7, 9 and the address marks 12 from the tracks on the disk shown in Fig. 4. When the tracks P_1 and P_3 are read, waveforms shown in Fig. 6(a) are derived. An address mark signal corresponding to one address mark 12 is reproduced from instant t_0 to t_1. An address mark signal corresponding to one address mark 7 is reproduced from instant t_2 to t_3. After the disk makes one revolution in time T_0, the tracks P_2 and P_4 are read. The waveforms of the resulting signals are shown in Fig. 6(b). An address mark signal corresponding to one address mark 12 is reproduced from instant $(T_0 + t_0)$ to $(T_0 + t_1)$. An address mark signal corresponding to one address mark 9 is reproduced from instant t_4 to t_5.

Referring to Fig. 7, there is shown a portion of a further disk 1 according to the invention. The disk 1 has V-shaped pregrooves 2. Since the interval or pitch p between successive tracks is equal to the width t of the tracks, geometrical variations 7 and 9 corresponding to address signals are formed at the same width as the pitch p between the tracks. In the conventional disk, geometrical variations or features of neighboring tracks

neighbor each other, producing a very large amount of crosstalk. This has made it almost impossible to put the conventional disk into practical use. In contrast, in the novel disk shown in Fig. 7, the geometrical variations 7 and 9 of neighboring tracks are so disposed that they do not neighbor each other. Hence, no crosstalk is produced. Consequently, the disk can be put into practical use. The disk master is fabricated by forming the V-shaped pregrooves 2 by mechanical cutting. The geometrical variations 7 and 9 corresponding to address signals are formed by changing the depth or height of the pregrooves 2.

Industrial Applicability

As described thus far, in accordance with the present invention, address signals indicating the addresses of neighboring tracks or pregrooves are so recorded on a disk that they do not neighbor one another. Therefore, when the address signals are read, no crosstalk is produced, and address signals can be obtained very stably. Consequently, every item of information recorded on the disk can be stably distinguished. Also, even if the disk tilts radially, no crosstalk is generated. This permits the use of disk whose surfaces make wavy motion.

Claims

1. A disk-type recording medium having circular or spiral tracks which are radially and regularly spaced from one another and which store information, each track having pregrooves, ridges, or protrusions and discrete depressions, ridges, or protrusions corresponding to identifying signals, the pregrooves, ridges, or protrusions having pits corresponding to signals, the discrete depressions, ridges, or protrusions being so disposed in the tracks that the depressions, ridges, or protrusions of neighboring tracks do not neighbor one another.

2. A disk-type recording medium according to claim 1, wherein the discrete depressions, ridges, or protrusions corresponding to identifying signals are wider than the pits corresponding to signals.

3. A disk-type recording medium according to claim 1, wherein geometrical variations corresponding to mark signals precede the discrete depressions, ridges, or protrusions corresponding to identifying signals.

4. A disk-type recording medium according to claim 1, wherein the pregrooves are V-shaped grooves.

FIG.1

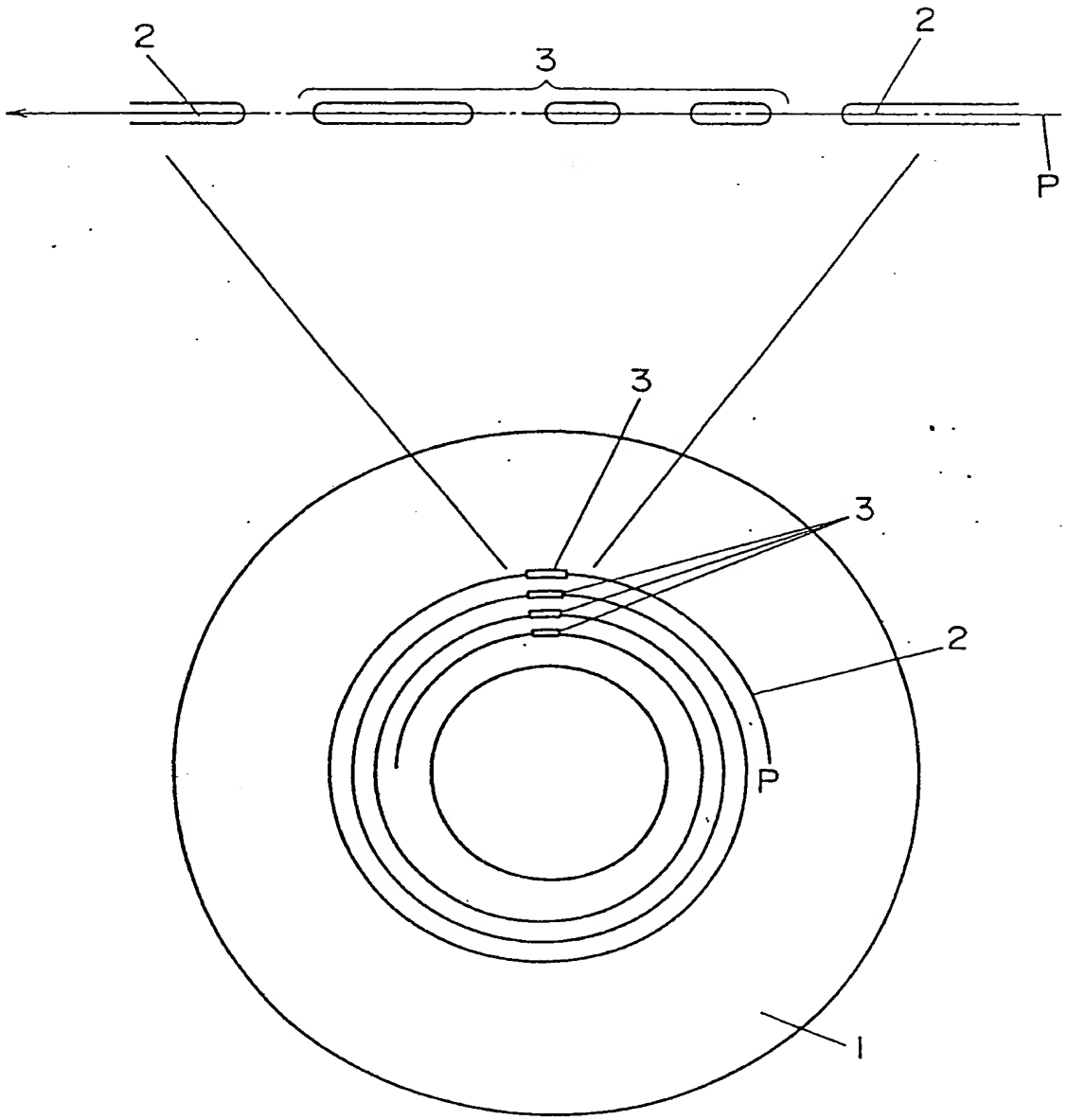


FIG. 2

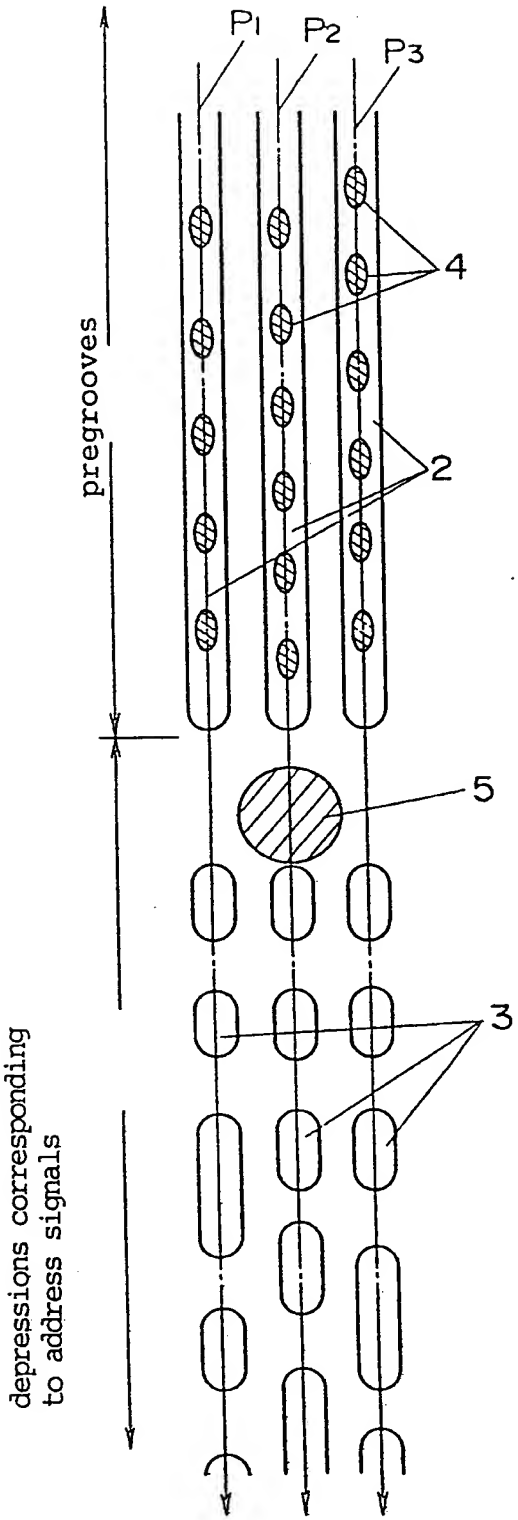


FIG. 3

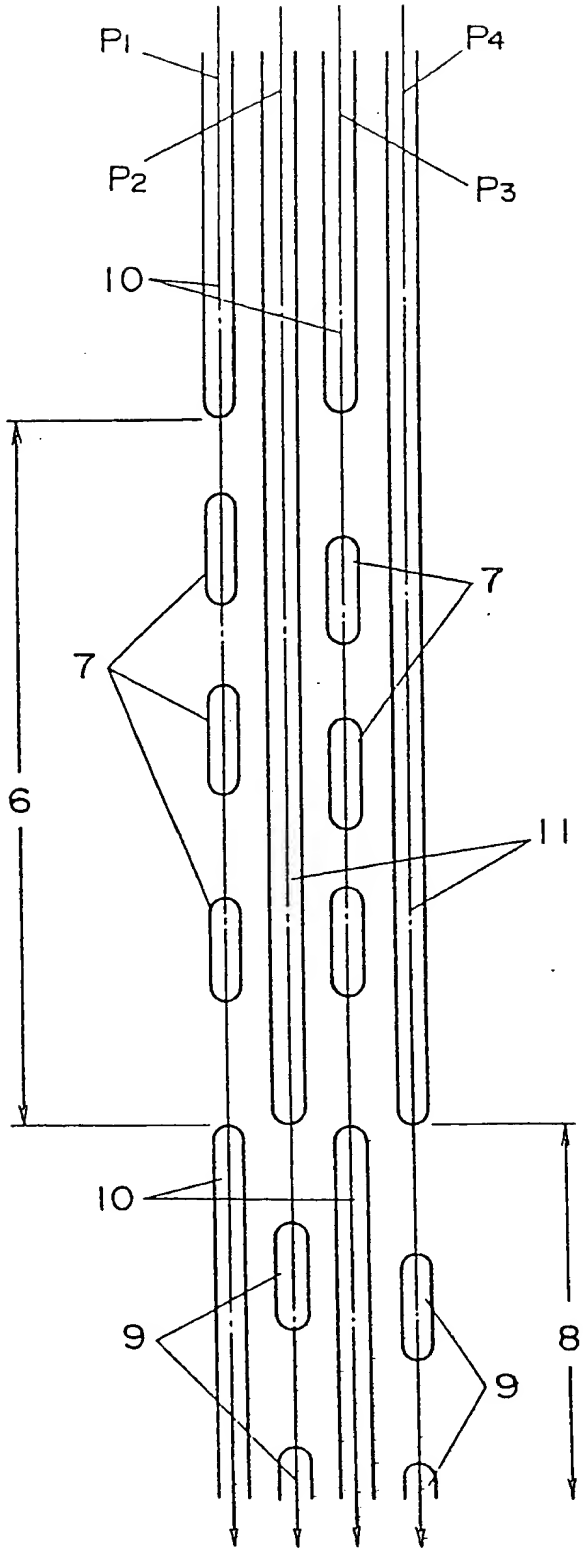


FIG. 4

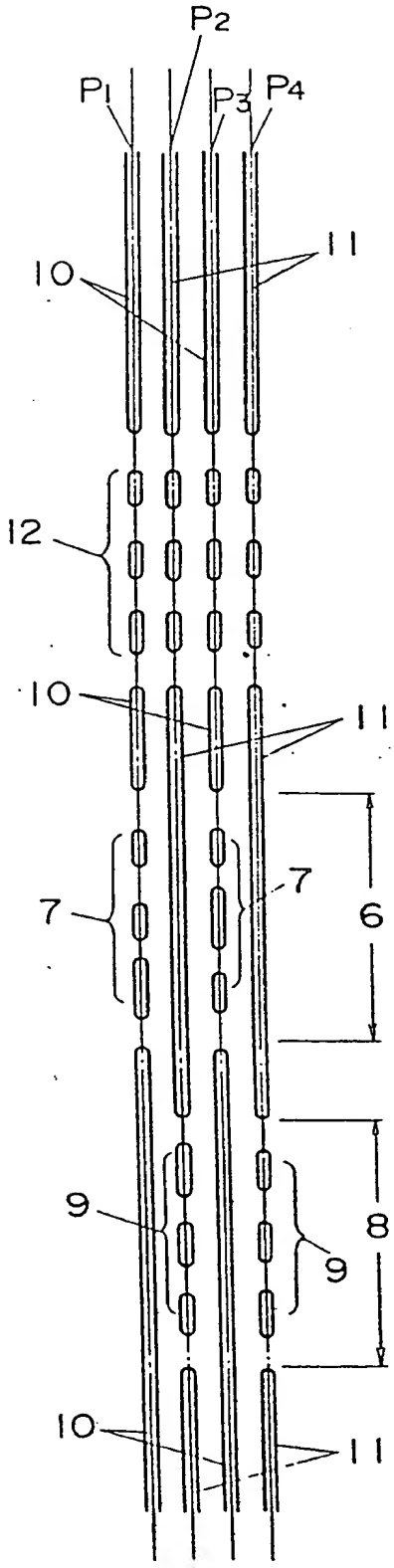


FIG. 5

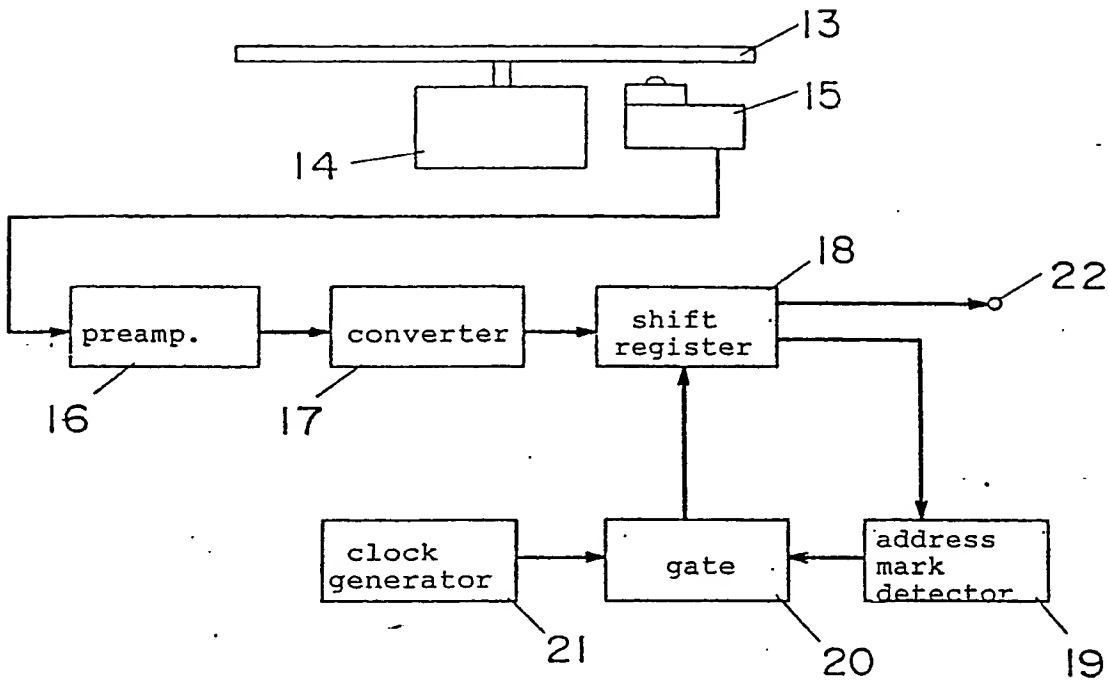

13
15
14
18
22
preamp.
converter
shift register
16
17
clock generator
gate
address mark detector
21
20
19

FIG. 6

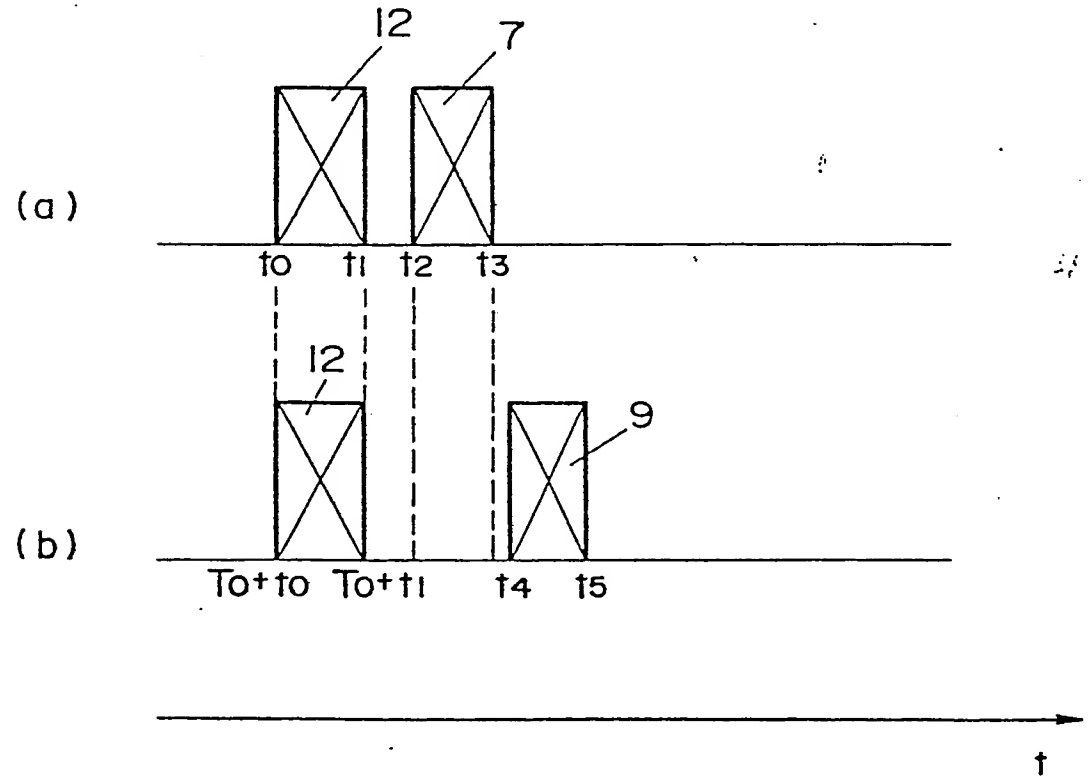
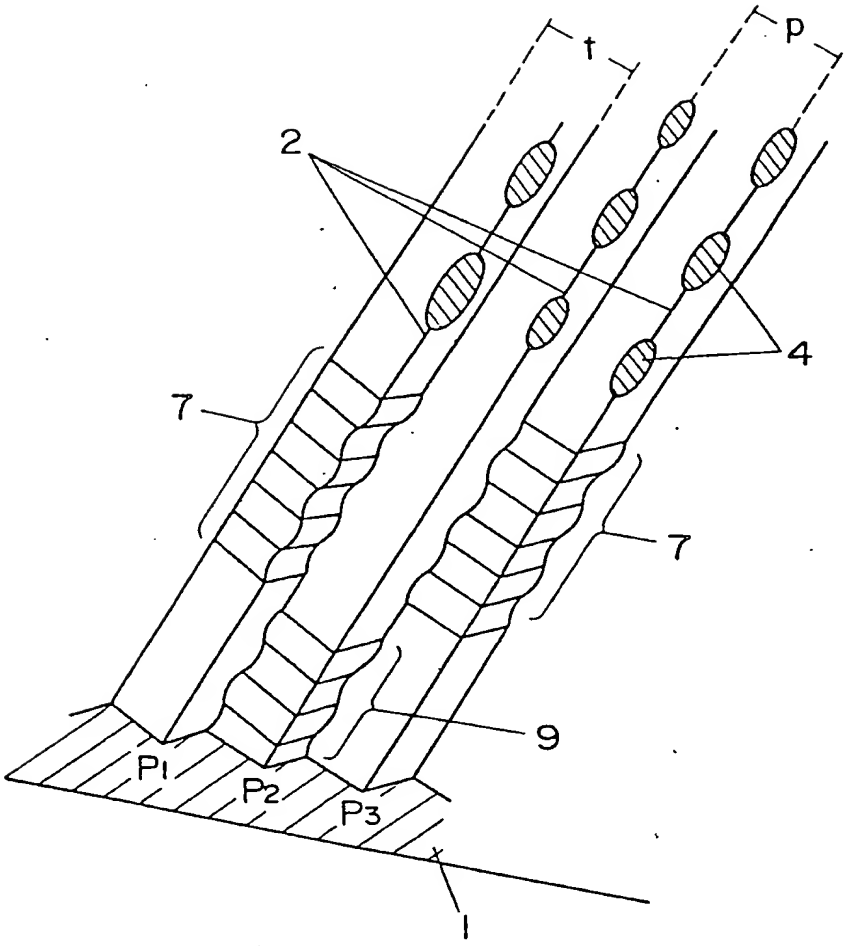

12
7
(a)
to
t1
t2
t3
12
9
(b)
To+to
To+t1
t4
t5
t

FIG. 7



List of reference numerals used in the drawings

1 ... disk-type recording medium (disk)

2 ... pregroove

3 ... depression corresponding to address signal

4 ... pit corresponding to signal

5 ... laser beam for playback

6 ... section

7 ... depression corresponding to address signal

8 ... section

9 ... depression corresponding to address signal

10 ... pregroove

11 ... pregroove

12 ... address mark corresponding to address mark signal

13 ... disk

14 ... electric motor

15 ... optical head

16 ... preamplifier

17 ... converter

18 ... shift register

19 ... address mark detector

20 ... gate

21 ... clock generator

22 ... output terminal

INTERNATIONAL SEARCH REPORT

International Application No PCT/JP85/00488

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl[4] G11B7/007, G11B7/24

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
IPC	G11B7/00 – 7/013, G11B7/24

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

Jitsuyo Shinan Koho 1971 - September 1985
Kokai Jitsuyo Shinan Koho 1971 - September 1985

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category*	Citation of Document [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
A	JP, A, 58-108043 (Sony Corporation) 28 June 1983 (28. 06. 83) Column 5, line 1 to column 10, line 8 (Family: none)	1
Y	JP, A, 58-12149 (Nippon Columbia Co., Ltd.) 24 January 1983 (24. 01. 83) Column 14, line 6 to column 15, line 7 & DE, A1, 3225809	1
Y	JP, A, 58-32239 (Hitachi, Ltd.) 25 February 1983 (25. 02. 83) column 6, line 3 to column 8, line 1 (Family: none)	1
Y	JP, A, 58-102347 (Mitsubishi Electric Corporation) 17 June 1983 (17. 06. 83) (Family: none)	1
A	JP, A, 59-30252 (Toshiba Corporation) 17 February 1984 (17. 02. 84) Column 5, line 6 to column 8, line 7 (Family: none)	2, 4

* Special categories of cited documents: [15]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
November 19, 1985 (19.11.85)	December 9, 1985 (09.12.85)
International Searching Authority [1]	**Signature of Authorized Officer [20]**
Japanese Patent Office	

Form PCT/ISA/210 (second sheet) (October 1981)

0193614

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

A	JP, A, 57-103136 (Matsushita Electric Industrial Co., Ltd.) 26 June 1982 (26. 06. 82) & EP, A1, 54438	3

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE[10]

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers..... because they relate to subject matter[12] not required to be searched by this Authority, namely:

2. ☐ Claim numbers..... because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out[13], specifically:

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING[11]

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.